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Botanical Therapeutics for Peptic Ulcer Disease: A Systematic Review of Anti-Ulcerogenic Herbs

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ABSTRACT

Peptic ulcer disease PUD marked by mucosal damage in the stomach or duodenum continues to be a significant gastrointestinal issue globally. Although traditional treatments such as proton pump inhibitors H2 receptor antagonist and antibiotics have enhanced patient outcomes, problems like drug resistance side effects and ulcer reoccurrence remain recently there has been a growing interest in herbal medicine as a complementary or alternative approach for PUD. Various medicinal plants have shown anti ulcer properties through different mechanisms including antioxidant effects cytoprotection reduction of gastric acid secretion and inhibition of Helicobacter pylori. This systemic review examines the therapeutic potential of antihistamine herbs summarizing findings from both preclinical and clinical research and identifying key phytochemicals that contribute to gastric mucosal protection. The results advocate for incorporation of herbal therapies into the management of peptic ulcers while also stretching the importance of standardized formulation through clinical assessment.

Keywords: - Peptic Ulcer Disease, H2 Receptor Antagonist, Helicobacter Pylori

INTRODUCTION

Peptic ulcer disease (PUD) is a prevalent gastrointestinal disorder characterized by the formation of open sores or lesion in the stomach lining or the upper small intestine [1, 2]. This condition result from an imbalance between harmfull factor such as gastric acid pepsin H.Pylori infection and the use of Non-Steroidal anti-inflammatory Drugs (NSAIDs) and protective mechanisum like mucus production, bicarbonate secreation and mucosal blood circulation [3]. PUD affects the millions worldwide leading to significant health issues increases healthcare costs & diminished quality of life [2]. While standard treatment including like proton pump inhibitors (PPIs), H2 Receptors antagonist, Antacids, & antibiotic treated H.pylori are gernally affective they come with limitation [4,5]. Concerns about recurrence side effect growing antimicrobial resistance and treatment costs have led to a search for a alternative therapies [6]. Across various culture traditional medicine has utilized plant based treatment for digestive disorder inculuding [7, 8]. In recent decades there has been a surge in scientific intrest in medicinal plants know their anti-ulcer properties driven by historical application bioactive compounds & potential safety benefits. Herbs like licorice, ginger, turmeric & holy basil have demonstrated potential in both experimental & some clinical studies for their ability to aid in ulcer healing & mitigate gastric inflammation [9-11]. This review seeks to systematically explore the role of anti-ulcer herbs managing PUD, emphasizing their mechanism of action bioactive components and their scientific evidence supporting their effectiveness by integrating traditional knowledge with contemporary pharmacological research. This article underscores the promise of botanical therapies in improving existing ulcer prevention and treatment strategies [12].

1.1 Global Prevalence and Health Impact

Peptic ulcer disease (PUD) remains a major public health concern, impacting approximately 5–10% of individuals worldwide at some stage in their lives [3, 2]. This condition primarily manifests as gastric ulcers in the stomach or duodenal ulcers in the proximal duodenum, often due to Helicobacter pylori infection or the extended use of non-steroidal anti-inflammatory drugs (NSAIDs) [1]. Despite improvements in diagnostic and treatment methods, PUD continues to be widespread in both developing and developed nations, leading to significant morbidity, decreased work efficiency, and increased healthcare expenses [2, 4]. Global statistics indicate that areas with limited healthcare access and inadequate sanitation have higher incidences of H. pylori infection, a leading factor in ulcer formation [13]. Additionally, the rising consumption of NSAIDs among older adults exacerbates the incidence of ulcers, resulting in serious complications such as gastrointestinal bleeding, perforation, and obstruction [2, 14]. These consequences not only diminish the quality of life for patients but can also pose life-threatening risks if not addressed [15].

1.2 Limitations of Conventional Treatments

Conventional peptic ulcer treatment—using PPIs, H2-receptor antagonists, mucosal protectants, and antibiotics—can effectively relieve symptoms and promote healing [1]. However, limitations include rising antibiotic resistance (notably to clarithromycin and metronidazole) [16], adverse effects from long-term PPI use (e.g., nutrient deficiencies, kidney issues, microbiota imbalance) [17-19], frequent ulcer recurrence (especially with continued NSAID use or H. pylori reinfection) [2, 20], and high costs in low-resource settings. These challenges underscore the need for safer, more accessible, and sustainable therapies.[3]

2. Pathophysiology of Peptic Ulcers

Peptic ulcers are sores that develop in the mucosal lining of the stomach or duodenum due to an imbalance between harmful and protective elements in the gastrointestinal system. The development of peptic ulcer disease (PUD) is influenced by several critical factors, such as bacterial infections, medication-related damage, excessive production of gastric acid, and oxidative stress. [21]

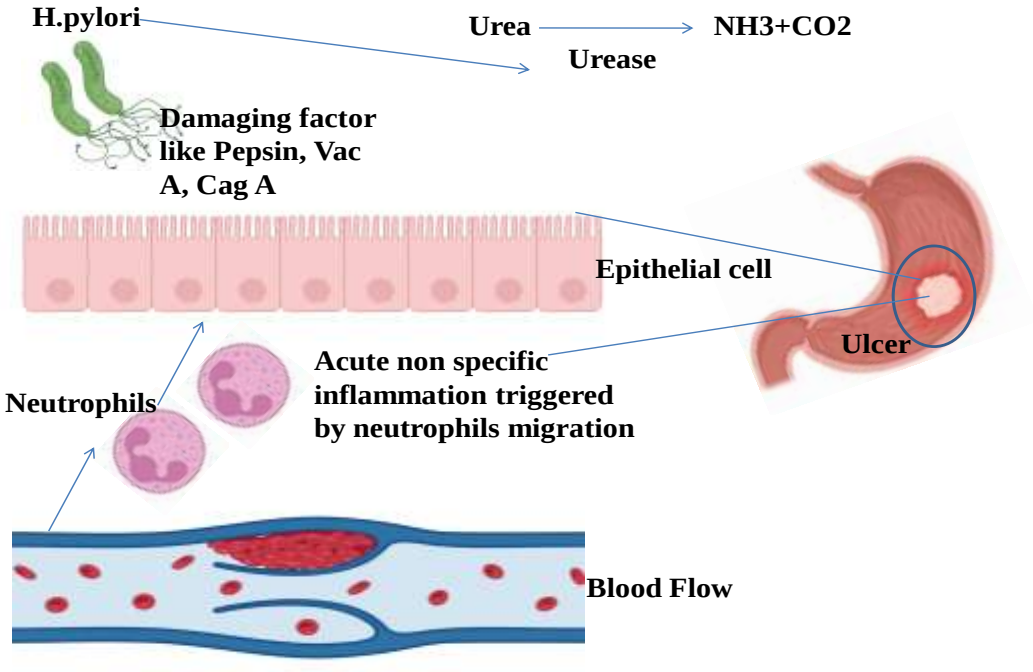

Fig. No. 01 Pathophysiology of Ulcer

CONVENTIONAL VS. HERBAL THERAPY

3.1 Current Drug Therapy for Peptic Ulcer Disease

The main objectives of traditional peptic ulcer treatment are to decrease gastric acid production, eliminate Helicobacter pylori infection, and facilitate mucosal repair. Typical treatment protocols generally consist of: [22]

- Proton Pump Inhibitors (PPIs): Medications like omeprazole, lansoprazole, and pantoprazole that irreversibly block the H^+/K^+ ATPase enzyme in gastric parietal cells, leading to a significant reduction in acid secretion [23].
- H2-Receptor Antagonists: Drugs such as ranitidine and famotidine that inhibit histamine-triggered acid secretion [24].
- Antibiotics: Clarithromycin, amoxicillin, and metronidazole are frequently utilized alongside acid suppressants to eliminate H. pylori [25].

- Mucosal protective agents: Including sucralfate, misoprostol, and bismuth compounds that safeguard the gastric lining. While these treatments are effective, they often necessitate prolonged use and combination therapies, especially in cases positive for H. pylori [26, 27].

Side Effects and Recurrence Issues

While traditional treatments can manage symptoms and facilitate recovery, various limitations hinder their long-term effectiveness:

- Side effects: Long-term use of PPIs and H2 blockers may result in nutrient malabsorption (such as calcium, magnesium, and vitamin B12), an elevated risk of fractures, kidney impairment, and disruption of gut microbiota. Antibiotics can lead to gastrointestinal issues and foster antimicrobial resistance [28, 29].
- Ulcer recurrence: Factors such as incomplete eradication of H. pylori, ongoing NSAID consumption, and lifestyle choices can result in frequent ulcer recurrences [27].
- Antibiotic resistance: The rising resistance to antibiotics, particularly clarithromycin and metronidazole, poses a significant obstacle in effectively managing H. pylori [30].
- Accessibility and cost: In areas with limited resources, high treatment expenses and inadequate diagnostic capabilities impede prompt and effective treatment. These challenges have prompted researchers and healthcare professionals to explore alternative or complementary treatment options that are safer, more cost-effective, and sustainable [31].

Growing Interest in Plant-Based Medicines

Herbal remedies, historically utilized in traditional medical practices like Ayurveda, Traditional Chinese Medicine, and various folk treatments, are increasingly recognized worldwide as effective alternatives or supplements to synthetic medications for gastrointestinal issues, including peptic ulcers. This rising interest can be attributed to several key factors:

- Diverse therapeutic properties: Numerous medicinal plants exhibit a range of effects, including anti-inflammatory, antioxidant, cytoprotective, antimicrobial, and antisecretory actions, providing a comprehensive strategy for managing ulcers [32].
- Reduced side effects: When used appropriately, herbal treatments are typically well-tolerated and present fewer negative effects compared to conventional drugs [33].
- Abundant phytochemicals: Active compounds such as flavonoids, alkaloids, tannins, Terpenoids, and saponins play a crucial role in the anti-ulcer properties of these herbs [34].
- Greater accessibility and affordability: Herbal solutions are often easier to obtain and less expensive, especially in rural and economically disadvantaged areas [33].
- Compatibility with integrative medicine: As healthcare practices advance, there is an increasing acceptance of integrative methods that merge evidence-based traditional medicine with contemporary treatments. Given the promising therapeutic benefits of these botanicals, additional research into their effectiveness, mechanisms of action, and clinical safety is essential to confirm their role in treating peptic ulcers [34].

Mechanisms of Anti-Ulcerogenic Activity in Plants

Medicinal plants demonstrate a diverse array of biological activities that play a significant role in their protective effects against peptic ulcer disease (PUD).

The anti-ulcer properties of these herbs are primarily due to the combined effects of different phytochemicals that influence oxidative stress, regulate gastric acid secretion, enhance mucosal defense, and reduce inflammation. The following outlines the main mechanisms by which these plants provide gastroprotective benefits [35].

Table No. 01 Mechanism of other activity in peptic Ulcer [36-42]

Mechanism	Description	Example Plants / Phytochemicals	Impact on Peptic Ulcers
Antioxidant Action	Scavenging free radicals and reducing oxidative stress by enhancing endogenous antioxidant enzymes.	Curcuma longa (curcumin), flavonoids, phenolics	Prevents mucosal damage and promotes healing by reducing lipid peroxidation.
Cytoprotective Effects	Increasing secretion of mucus, bicarbonate, and prostaglandins to strengthen the mucosal barrier.	Glycyrrhiza glabra (licorice), mucilaginous herbs	Protects gastric lining, preventing erosion and ulcer formation.
Antisecretory Effects	Reducing gastric acid and pepsin secretion by inhibiting proton pumps or blocking histamine/gastrin signals.	Ocimum sanctum (holy basil), tannins	Limits acid damage to the mucosa, facilitating ulcer healing.
Anti-Helicobacter pylori Activity	Inhibiting growth, urease activity, or adhesion of H. pylori bacteria.	Allium sativum (garlic), Zingiber officinale (ginger)	Reduces bacterial-induced inflammation and ulcer formation.
Anti-inflammatory and Wound-Healing	Suppressing inflammatory cytokines and promoting tissue repair, angiogenesis, and collagen synthesis.	Aloe vera, flavonoids, terpenoids	Decreases inflammation and accelerates ulcer healing and mucosal regeneration.

Table No: 02 Review of Anti-Ulcerogenic Medicinal Plants [43-49]

Plant Name	Active Compounds	Traditional Uses & Mechanisms	Study Outcomes
Glycyrrhiza glabra (Licorice)	Glycyrrhizin, flavonoids	Mucosal protection, anti-H. pylori activity	Effective in animal and human studies; promotes healing and reduces inflammation
Zingiber officinale (Ginger)	Gingerols, shogaols	Antioxidant, anti-inflammatory, gastric mucosal protection	Shown to reduce ulcer severity in NSAID and stress models in animals
Aloe vera	Polysaccharides	Enhances mucus secretion, wound healing, reduces inflammation	Accelerates ulcer healing and protects gastric lining in animal studies
Curcuma longa (Turmeric)	Curcumin	Anti-inflammatory, antioxidant, antimicrobial	Reduces gastric inflammation and promotes healing; supported by clinical data
Ocimum sanctum (Holy Basil)	Eugenol, ursolic acid	Protects against NSAID-induced ulcers, reduces acid secretion	Demonstrated gastroprotection and ulcer healing in animal models

Key Phytochemicals and Their Roles in Anti-Ulcerogenic Activity

Phytochemicals are bioactive compounds present in plants that contribute significantly to their therapeutic effects, including the prevention and treatment of peptic ulcers. Various classes of phytochemicals exert specific mechanisms that protect the gastric mucosa, reduce inflammation, and promote healing [50-55].

Phytochemical	Role/Mechanism	Examples of Effects	Plants Containing These Compounds
Flavonoids	- Antioxidant (scavenge free radicals) - Enhance endogenous antioxidant enzymes - Stimulate mucus and bicarbonate secretion - Inhibit acid secretion	Protects mucosa from oxidative damage, strengthens barrier, reduces acid secretion	Glycyrrhiza glabra, Camellia sinensis, Citrus species
Tannins	- Astringent (precipitates proteins to form protective layer) - Anti-inflammatory (inhibit COX and LOX enzymes) - Antimicrobial against H. pylori	Protects ulcer site, reduces inflammation, inhibits bacterial growth	Terminalia chebula, Punica granatum, Camellia sinensis
Terpenoids	- Promote mucosal healing (angiogenesis, collagen synthesis) - Anti-inflammatory (inhibit cytokines) - Reduce gastric acid secretion	Accelerates wound repair, decreases inflammation, limits acid damage	Ocimum sanctum, Rosmarinus officinalis, Curcuma longa
Alkaloids	- Anti-inflammatory and antimicrobial - Increase mucus secretion - Inhibit acid secretion	Protects mucosa, reduces inflammation and bacterial colonization	Berberis vulgaris (berberine), various medicinal plants
Saponins	- Increase mucus production - Anti-inflammatory - Immune-modulating properties	Strengthens mucosal barrier, reduces inflammation	Glycyrrhiza glabra, Panax ginseng

Challenges

Although there is encouraging evidence for the anti-ulcer properties of numerous medicinal plants, various obstacles impede their broad clinical use. It is essential to tackle these challenges to fully realize their therapeutic advantages.

- Lack of Well-Designed Human Clinical Trials
- Need for Bioactive Compound Isolation
- Pharmacokinetic and Toxicological Studies
- Integration into Modern Therapy

CONCLUSION

This review emphasizes the considerable potential of various medicinal plants and their bioactive phytochemicals in both preventing and treating peptic ulcer disease. A variety of herbs demonstrate diverse anti-ulcerogenic properties, such as antioxidant, cytoprotective, antisecretory, anti-Helicobacter pylori, and anti-inflammatory effects. These mechanisms work together to provide mucosal protection, facilitate ulcer healing, and alleviate symptoms. Herbal remedies offer a promising complementary or alternative strategy to traditional treatments, especially given the drawbacks of proton pump inhibitors, antibiotics, and other standard medications—such as adverse effects, recurrence, and drug resistance. Additionally, the extensive biodiversity of plant species presents a significant opportunity for identifying new compounds with therapeutic benefits. However, despite positive preclinical and some clinical findings, the broader implementation of herbal anti-ulcer treatments is hindered by issues related to safety, standardization, dosage, and a lack of high-quality human trials. Consequently, there is an urgent need for thorough scientific research, including well-structured clinical trials, pharmacokinetic and toxicological evaluations, and standardization guidelines. In conclusion, the incorporation of botanical therapies into contemporary peptic ulcer management shows great potential but necessitates ongoing multidisciplinary research efforts to guarantee efficacy, safety, and adherence to regulations. This will ultimately enhance patient care and broaden the range of effective, natural treatment options for peptic ulcer disease.

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Ethical consent

This review article does not involve original research involving human participants or animals. Therefore, ethical approval and informed consent were not required.

Conflicts of interest

There are no conflicts of interest.

Future direction

Future prospects in herbal treatment for peptic ulcers include advanced phytochemical research, clinical validation, herbal-drug synergy, innovative delivery systems, personalized herbal medicine, and standardized formulations for regulatory approval.

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